Appendix G

"Construction Management Training: An Industry/Academia Challenge"

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Construction Management Training

An Industry/Academia Challenge

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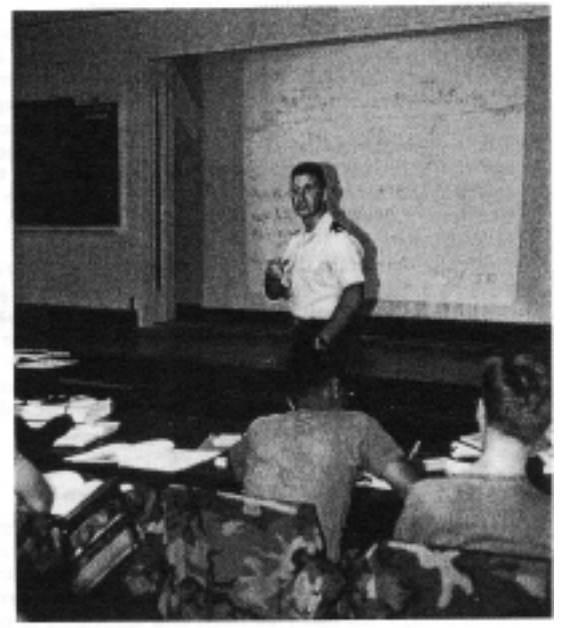
OVER the last couple of years, a continuing dialogue has been occurring throughout the United States about "more construction for the money." This is the result of the work done by The Business Roundtable in evaluating problems in the construction industry. Many recommendations from these evaluations relate to better leadership, safety, scheduling, and management. This brings us to the basic question: "Where do managers come from to oversee today's investment of billions of dollars in construction?"

There are 325,000 people who manage construction projects and the majority have learned or are learning on the job. Many are good solid managers. A basic concern, however, is the cost paid in mistakes, correcting errors, climbing the steep learning curve, and, to a lesser degree, from a narrow perspective due to continued association with a specific type of work, often in the same location.

Interestingly, there is no shortage of school-trained business managers. The formal education systems in the United States and throughout the world have long produced bachelors and masters of business administration. This is not the case with construction engineering and management. Prior to 1960, management courses relating to engineering and construction were rare and, conversely, engineers were rarely found in management.

In the absence of academia as a source, one of the principal fields for training engineer managers has been the military. The assignment and promotion systems within the military move young men from job to job to management. Consequently, he learns-and expects to learn-to manage people after on-the-job experience. Perhaps this is why so many chief executives or chief operating officers of large firms come from the military.



Many CEO's and other top managers of design and construction firms come from the military ranks. The assignment and promotion system moves young men and women from job to job and then into the managerial ranks. The Engineer Officer's Basic Course at Ft. Belvoir is often the start of just such a career in construction management.

Changes in Academia

The situation in education began to change in the mid-1960's. Courses in industrial engineering began to appear and Stanford University started a construction engineering program and offered a degree. These events were regarded with some curiosity. In the late 1950's I was responsible for the assignments of Engineer officers below the grade of Colonel; and, at that time, our Chief of Engineers' policy was for 95 percent of the Engineer officers to have bachelor degrees and one-half to have graduate degrees.

In selecting courses for our officers to attend, we looked for civil, electrical, and mechanical. We considered industrial and construction engineering as peripheral and not mainstream types of education. This concept continued for some years, so the problem was not only a shortage of educational institutions which provided training in management, but the profession itself was not too concerned about the value of this training.

Recently, however, changes have begun and today 60 universities include construction engineering management courses in their curricula. Of these, 44 have courses at the graduate level; however, most of them offer no degree program. Universities offering degrees

often include courses in both engineering and business. Overall, however, there is no specified or basic group of courses or standard for recipients of Construction Engineering Management degrees.

Other problems also exist, such as the lack of qualified teachers. This does not mean that those who are teaching are not excellent people, but they have limited experience in construction engineering management. Also, teachers receive lower salaries than those who use similar or the same talents on the *job.* There are other problems in the universities, such as the competition for the course offered by the College of Business, College of Engineering, or the College of Architecture.

Equally important are the industry's lack of interest in seeing that educational institutions do a good job and a general lack of acceptance of construction management as a profession. Finally, there is a shortage of dollars for research-research being the amount of money universities need to supplement instructors' pay and also to underwrite an investigation to solve various problems related to management.

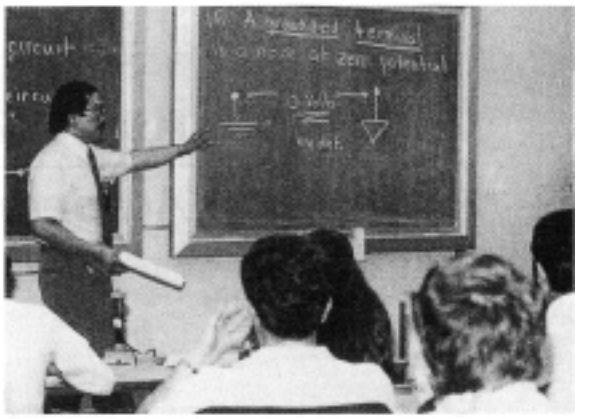
The University of Maryland Program

In the fall of 1982, I was asked to help the University of Maryland set up a Construction and Entzineerine Management course. Why they asked me is not entirely clear. Nevertheless, having had 40 years experience in the field, I had many contacts and associates to call on for help. In becoming involved in the situation, I learned that some of the problems I just related had been recognized and were being resolved at Maryland. Most important, this course had been financed by the generous donation by a Regent of the University of Maryland, James A. Clark, of Hyman Construction Company and Omni Construction. Also, the College of Engineering took firm control by initiating and assuming responsibility for the program.

A committee was established (with Mr. Clark as chairman and myself as vice chairman) to develop this construction engineering and management program. The committee also included individuals from Stanford University, the Corps of Engineers, the University of Maryland, and industry.

Establishing Course Criteria

We began our work with a survey, by personal contact and letter, of principal executives of some major U.S. companies involved in engineering and construction. We asked these leaders one fundamental question: "If you were to receive a graduate from the University of Maryland's Construction Engineering Management course, what would be the educational assets that you would like him to bring to you?" From



Engineering teachers in academia generally receive lower salaries than those in industry, contributing to a genera/ shortage of college teachers.

the responses to this survey, we developed a White Paper, which included certain basic conclusions.

- The course would be a graduate-level program. The committee, based on input from industry, concluded that not all B.S. degree undergraduates knew if they were managerial material and if they wanted to go into management.
- We felt that a strong B.S. degree program was essential to developing good construction engineering managers. Consequently, we did not wish to weaken the criteria and degree requirements in the basic fields of engineering.
- The graduate-level approach gave industry leaders the time to evaluate an individual's potential for growth as a manager.

The White Paper recommended 30 credit hours, of which four courses (or 12 hours), would be from the College of Business. The remaining six courses, or 18 credit hours, would be from the College of Engineering. This turned out to be a very good breakdown and allowed us to start our course using available assets. The industry responses were fairly clear as to the subjects most valuable to them. The following were mentioned in the industry leader responses in the percentagesshown:

Contractual Law 82%
Construction Methods... 82%
Leadership 75%
Financial Management... 75%
Managerial Systems..... 73%
Cost Control 55%

Subjects mentioned less frequently included project simulation, local relations, materials, mega-projects statistics,andaccounting.

The White Paper was approved by the appropriate authorities and classes began in 1984. By 1985, a faculty of four was established and hired, and the student load had grown to be the second largest in the graduate-level engineering course. A class on one subject was attended by 40 students, of which half came from industry.

The construction industry, which is served by academia, should help evaluate university CM programs and speak out on how well the universities are doing.

Evaluating the Program

Having been privileged to be the first Chair Professor in charge of the graduate-level Construction Engineering and Management course and having overseen the beginning of the instructions in the spring of 1984, I was interested to know how well our course correlated with other university courses and also with the industry's needs. An evaluation of the latter was based on five inputs: the Associated General Contractors had completed a study involving 431 responses; The Business Roundtable, 112; Project Management Institute, 59; Frederick Mueller's independent study for a doctorate degree, 44; and the earlier mentioned University of Maryland survey. By evaluating these data, we were able to provide a list of sought-after skills in a single industry.

We then surveyed the 44 universities mentioned above. They were fairly well distributed geographically-8 in the far west; IO, mid-continent; Il, midwest; 7, northeast; and 8 in the south. This distribution meant that not only did we see what was happening in that regard regionally, but we were also able to bring in all major schools in the country that have construction engineering and management programs. The courses offered by these universities parallel quite closely the industry's needs. For example, among the IO courses appearing most often in the university survey, seven of them are mentioned in the broad industry survey which differed somewhat from the more limited University of Maryland survey of industry leaders. We also found that only four universities (9 percent) provided all seven and about 30 percent offered at least six. (The University of Maryland was one of the four universities that provided all of the courses requested by industry in the survey.)

- Planning and Scheduling
- Contract Law
- Project Management
- Construction Methods
- Cost Estimating/Engineering
- Engineering Economics/Cost Control
- Decision Making

Four subjects on the industry list were not included in the education institute survey results: Human relations-leadership; and financial, human resource, and business management. These four courses would be appropriate ones to be offered by the College of Business.

Improving Support to the Industry

Besides learning about the close correlation between the needs of industry and the university offerings, we identified two opportunities to improve the educational system's support of the industry's needs: To establish a core curriculum which would be adopted by all universities to serve more consistently the industry and for the industry to express a stronger voice in measuring academia.

The present perception of success at universities is often based on the amount of research money collected and how they compare to other universities in their peer group. This approach seems somewhat off target because engineering is a science and management is an art. It is not only difficult but also inappropriate for engineering colleges to evaluate success and management training in the same way as they do engineering education. Scientists are not necessarily good management teachers. Therefore, the industry served by academia should help evaluate university programs through the quality of the product and speak out on how well the universities are doing.

THE educational systems in the U.S. are steadily expanding their programs for developing construction engineering managers. This effort is timely-in fact, overdue if the U.S. engineering and construction industries are to keep pace internationally and domestically by becoming more efficient at the project and program levels. Even so, academia should not proceed without carefully targeting their efforts at the needs of the industry that their products will enter.

The trick to total success depends on close and continuing relationships between the universities and the engineering construction industries to develop a core curriculum for construction engineering courses and to establish, within industry, a mechanism to evaluate how well the product being provided by our universities meets their needs. Bringing these two elements together will require co-ordination and planning. SAME, as part of its support of "More Construction for the Money" endeavor, seems a likely and qualified candidate to guide and manage this much-needed effort. 8

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